

# PATENT ABSTRACTS OF JAPAN

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## (54) ENCODER AND DECODER

(57)Abstract:

PROBLEM TO BE SOLVED: To obtain coded and decoded signals without the power loss of an original signal by providing a bit assigning means and a quantization means etc. quantizing plural partial band signals generated by a band dividing means based on bit assigning information generated by this assigning means.

SOLUTION: A band dividing part 1 divides an input signal into plural partial bands and outputs a partial band signal. An acoustic sense model part 3 spectrum-analyzes the input signal furthermore analyzes it based on human acoustic sense characteristic and calculates an evaluation function for executing optimum bit-assigning by a bit assigning part 4 in consideration of a maximum value from a maximum value detection part 2. The part 4 decides optimum bit assignment for each partial band based on this evaluation function. A quantization part 5 normalizes the partial band signal in each partial band from the part 1 by the maximum value from the part 2 for improving quantization efficiency and quantizes and encodes it according to bit assignment from the part 4.

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## CLAIMS

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[Claim(s)]

[Claim 1]An encoder comprising:

A zone division means to divide an input signal into two or more partial zones and to generate two or more partial zone signals.

An auditory model means to conduct spectrum analysis of the above-mentioned input

signal based on a masking rule of human being's aural characteristic and to compute a valuation function over two or more above-mentioned partial zones.

A reference bit quota table which memorizes predetermined reference bit quota information to the above-mentioned partial zone.

Based on a valuation function computed by reference bit quota information and the above-mentioned auditory model means of the above-mentioned reference bit quota table, a bit quota means to generate bit quota information for quantizing two or more partial zone signals generated by the above-mentioned zone division means, and a quantization means which quantizes two or more partial zone signals generated by the above-mentioned zone division means based on bit quota information generated by the above-mentioned bit quota means.

[Claim 2] An encoder comprising:

A zone division means to divide an input signal into two or more partial zones and to generate two or more partial zone signals.

A power calculating means which computes power of two or more partial zone signals generated by the above-mentioned zone division means.

An auditory model means to conduct spectrum analysis of the above-mentioned input signal based on a masking rule of human being's aural characteristic and to compute a valuation function over two or more above-mentioned partial zones.

A reference bit quota table which outputs predetermined reference bit quota information to a partial zone based on calculation power of a partial zone of the above-mentioned power calculating means. A bit quota means to generate bit quota information for quantizing two or more partial zone signals generated by the above-mentioned zone division means based on a valuation function computed by reference bit quota information and the above-mentioned auditory model means of the above-mentioned reference bit quota table. A quantization means which quantizes two or more partial zone signals generated by the above-mentioned zone division means based on bit quota information determined by the above-mentioned bit quota means.

[Claim 3] An encoder comprising:

A zone division means to divide an input signal into two or more partial zones and to generate two or more partial zone signals.

An auditory model means to conduct spectrum analysis of the above-mentioned input signal based on a masking rule of human being's aural characteristic and to compute a valuation function over two or more above-mentioned partial zones.

A reference bit quota table which outputs predetermined reference bit quota information over a partial zone based on a spectrum-analysis result of the above-mentioned auditory model means.

A bit quota means to generate bit assignment for quantizing two or more partial zone signals generated by the above-mentioned zone division means based on a valuation function computed by reference bit quota information and the above-mentioned auditory model means of the above-mentioned reference bit quota table. A quantization means which quantizes two or more partial zone signals generated by the above-mentioned zone division means based on bit quota information determined by the above-mentioned bit quota means.

[Claim 4]An encoder comprising:

A zone division means to divide an input signal into two or more partial zonesand to generate two or more partial zone signals.

A maximum value detecting means which detects the maximum of two or more partial zone signals generated by the above-mentioned zone division means.

An auditory model means to conduct spectrum analysis of the above-mentioned input signal based on a masking rule of human being's aural characteristicand to compute a valuation function over two or more above-mentioned partial zones.

A reference bit quota table which memorizes predetermined reference bit quota information over a partial zone based on the maximum detected by the above-mentioned maximum value detecting meansA bit quota means to generate bit assignment for quantizing two or more partial zone signals generated by the above-mentioned zone division means based on a valuation function computed by reference bit quota information and the above-mentioned auditory model means of the above-mentioned reference bit quota tableA quantization means which quantizes two or more partial zone signals generated by the above-mentioned zone division means based on bit quota information determined by the above-mentioned bit quota means.

[Claim 5]An encoder which is provided with the following and characterized by outputting predetermined reference bit quota information in the above-mentioned reference bit quota means in consideration of a power loss when bit assignment to a partial zone decreases from a result of power tools of analysis of the above 1stand the 2nd power tools of analysis.

A zone division means to divide an input signal into two or more partial zonesand to generate two or more partial zone signals.

An auditory model means to conduct spectrum analysis of the above-mentioned input signal based on a masking rule of human being's aural characteristicand to compute a valuation function over two or more above-mentioned partial zones.

A reference bit quota table which memorizes predetermined reference bit quota information over the above-mentioned partial zone.

A bit quota means to generate bit assignment for quantizing two or more partial zone signals generated by the above-mentioned zone division means based on a valuation function computed by reference bit quota information and the above-mentioned auditory model means of the above-mentioned reference bit quota tableA quantization means which quantizes two or more partial zone signals generated by the above-mentioned zone division means based on bit quota information determined by the above-mentioned bit quota meansA local decoding means to decode coding data quantized by the above-mentioned quantization meansthe 1st power tools of analysis that computes power and spectrum of the above-mentioned input signaland 2nd power tools of analysis that computes power and spectrum of a decoded signal which were decoded by the above-mentioned local decoding means.

[Claim 6]An encoder comprising:

A zone division means to divide an input signal into two or more partial zonesand to generate two or more partial zone signals.

An auditory model means to conduct spectrum analysis of the input signal based on a masking rule of human being's aural characteristic and to compute a valuation function over two or more above-mentioned partial zones.

A bit quota means to generate bit quota information for quantizing two or more partial zone signals generated by the above-mentioned zone division means.

A quantization means which quantizes two or more partial zone signals generated by the above-mentioned zone division means based on bit quota information determined by the above-mentioned bit quota means. A power calculating means which asks for power of a partial zone signal of the above-mentioned zone division means and an adjustment device which adjusts a gain of an input signal corresponding to power of a partial zone searched for by the above-mentioned power calculating means.

[Claim 7] An encoder comprising:

A zone division means to divide an input signal into two or more partial zones and to generate two or more partial zone signals.

A maximum value detecting means which detects the maximum of an absolute value of two or more partial zone signals generated by the above-mentioned zone division means.

An auditory model means to conduct spectrum analysis of the input signal based on a masking rule of human being's aural characteristic and to compute a valuation function over two or more above-mentioned partial zones.

A bit quota means to generate bit quota information for quantizing two or more partial zone signals generated by the above-mentioned zone division means. A quantization means which quantizes two or more partial zone signals generated by the above-mentioned zone division means based on bit quota information defined by the above-mentioned bit quota means. An adjustment device which adjusts a gain of the maximum detected by the above-mentioned maximum value detecting means corresponding to power of a partial zone searched for by power calculating means which asks for power of a partial zone signal of the above-mentioned zone division means and the above-mentioned power calculating means.

[Claim 8] In the above-mentioned maximum adjustment device from bit quota information determined by the above-mentioned bit quota means and power information of a partial zone computed by the above-mentioned power calculating means. The encoder according to claim 7 performing a gain adjustment of the biggest maximum in consideration of a power loss when bit assignment to a partial zone becomes zero among the maximums to each partial zone detected by the above-mentioned maximum value detecting means.

[Claim 9] In the above-mentioned power calculating means from a spectrum analysis result in bit quota information and the above-mentioned auditory model means which were determined by the above-mentioned bit quota means. Claim 6 in consideration of a power loss when bit assignment to a partial zone becomes zero thru/or the encoder according to claim 8.

[Claim 10] From the maximum to a partial zone detected in the above-mentioned power calculating means by bit assignment determined by the above-mentioned bit quota means and the above-mentioned maximum value detecting means. Claim 6 in consideration of a power loss when bit assignment to a partial zone becomes zero thru/or the encoder according to claim 8.

[Claim 11] In [ have the following and ] the above-mentioned power calculating means In [ from a result with power tools of analysis of the above 1st and the 2nd power tools of analysis compute a power loss when bit quota information over a partial zone becomes zero and ] the above-mentioned gain-adjustment means Claim 6 thru/or the encoder according to claim 8 adjusting a gain over an input signal according to a power loss computed by the above-mentioned power calculating means.

A local decoding means to decode coding data generated by the above-mentioned multiplexing means.

1st power tools of analysis that computes power and spectrum of a signal which were inputted.

2nd power tools of analysis that computes power and spectrum of a decoded signal which were decoded by the above-mentioned local decoding means.

[Claim 12] A decoder comprising:

Separating mechanism which separates power information, bit quota information, maximum information, and sample information which are included in inputted coding data.

An inverse quantization means to decode a partial zone signal from the above-mentioned bit quota information, maximum information, and sample information.

A band composition means which carries out band composition of the partial zone signal decoded by the above-mentioned inverse quantization means.

A gain-adjustment means to perform a gain adjustment of a decoded signal by which band composition was carried out by the above-mentioned band composition means according to power information separated by separating mechanism.

[Claim 13] A decoder comprising:

Separating mechanism which separates power information, bit quota information, maximum information, and sample information which are included in inputted coding data.

An inverse quantization means to decode a partial zone signal from the above-mentioned bit quota information, maximum information, and sample information.

A band composition means which carries out band composition of the partial zone signal decoded by the above-mentioned inverse quantization means.

A power loss calculating means which computes a power loss over a partial zone from power information from the above-mentioned separation part, bit quota information, and maximum information. A maximum adjustment device which performs a gain adjustment of maximum information corresponding to a partial zone separated by the above-mentioned separation part according to a power loss computed by the above-mentioned power loss calculating means.

[Claim 14] A decoder which is provided with the following and characterized by generating noise which applied a lower-limit-of-hearing level in the above-mentioned partial zone signal generating means as a level of a partial zone signal generated to a partial zone whose bit assignment is zero.

Separating mechanism which separates bit quota information, maximum information, and sample information which are included in inputted coding data.

An inverse quantization means to decode a partial zone signal from the above-mentioned bit quota information, maximum information, and sample information.

A band composition means which carries out band composition of the partial zone signal decoded by the above-mentioned inverse quantization means.

A partial zone signal generating means which bit assignment judges a partial zone which is zero from bit quota information separated by the above-mentioned separating mechanism and generates the partial zone signal. A calculating means adding a partial zone signal decoded by the above-mentioned inverse quantization means and a partial zone signal generated by the above-mentioned partial zone signal generating means and a band composition means to compound a partial zone signal added by the above-mentioned calculating means to a signal of the original bandwidth.

[Claim 15] In [ have the following and ] the above-mentioned partial zone signal generating means. A decoder generating noise to which bit assignment applied a masking threshold level by a partial zone signal which is not zero from maximum information separated by the above-mentioned separating mechanism as a level of a partial zone signal which bit assignment generates to a partial zone which is zero.

Separating mechanism which separates bit quota information, maximum information and sample information which are included in inputted coding data.

An inverse quantization means to decode a partial zone signal from the above-mentioned bit quota information, maximum information and sample information.

A band composition means which carries out band composition of the partial zone signal decoded by the above-mentioned inverse quantization means.

A partial zone signal generating means which bit assignment judges a partial zone which is zero from bit quota information separated by the above-mentioned separating mechanism and generates the partial zone signal. A calculating means adding a partial zone signal decoded by the above-mentioned inverse quantization means and a partial zone signal generated by the above-mentioned partial zone signal generating means and a band composition means to compound a partial zone signal added by the above-mentioned calculating means to a signal of the original bandwidth.

[Claim 16] A decoder which is provided with the following and characterized by generating noise which applied a level memorized by the above-mentioned level information memory measure as a level of a partial zone signal generated in the above-mentioned partial zone signal generating means to a partial zone whose bit assignment is zero.

Separating mechanism which separates bit quota information, maximum information and sample information which are included in inputted coding data.

An inverse quantization means to decode a partial zone signal from the above-mentioned bit quota information, maximum information and sample information.

A level information memory measure which memorizes level information of a partial zone signal of the past frame.

A band composition means which carries out band composition of the partial zone signal decoded by the above-mentioned inverse quantization means. A partial zone signal generating means which bit assignment judges a partial zone which is zero from bit quota information separated by the above-mentioned separating mechanism and generates the partial zone signal. A calculating means adding a partial zone signal decoded by the above-mentioned inverse quantization means and a partial zone signal generated by the

above-mentioned partial zone signal generating means and a band composition means to compound a partial zone signal added by the above-mentioned calculating means to a signal of the original bandwidth.

[Claim 17] A decoder which is provided with the following and characterized by generating noise which applied maximum information separated by the above-mentioned separating mechanism in the above-mentioned partial zone signal generating means as a level of a partial zone signal generated in the above-mentioned partial zone signal generating means to a partial zone whose bit assignment is zero.

Separating mechanism which separates bit quota information, maximum information, and sample information which are included in inputted coding data.

An inverse quantization means to decode a partial zone signal from the above-mentioned bit quota information, maximum information, and sample information.

A band composition means which carries out band composition of the partial zone signal decoded by the above-mentioned inverse quantization means.

A partial zone signal generating means which bit assignment judges a partial zone which is zero from bit quota information separated by the above-mentioned separating mechanism and generates the partial zone signal. A calculating means adding a partial zone signal decoded by the above-mentioned inverse quantization means and a partial zone signal generated by the above-mentioned partial zone signal generating means and a band composition means to compound a partial zone signal added by the above-mentioned calculating means to a signal of the original bandwidth.

[Claim 18] In [ have a partial zone signal memory measure which memorizes a partial zone signal of a frame of the past outputted from the above-mentioned adding means and ] the above-mentioned partial zone signal generating means. Claim 14 which applies a partial zone signal of a frame of the past outputted from the above-mentioned partial zone signal memory measure. Claim 15, claim 16, the decoder according to claim 17.

[Claim 19] Claim 14 which applies a composite signal of a partial zone signal which contains target harmonic content and subharmonic ingredient of a partial zone in the above-mentioned partial zone signal generating means among each partial zone signal outputted from the above-mentioned inverse quantization means thru/or the decoder according to claim 17.

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## DETAILED DESCRIPTION

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[Detailed Description of the Invention]

[0001]

[Field of the Invention] This invention codes an input signal (for example, audible signal, such as a sound and musical tone) and relates to an encoder and a decoder which transmit or carry out record reproduction, decode, and acquire a regenerative signal.

[0002]

[Description of the Prior Art] There are various methods in high efficiency codings, such as an audible signal, and there is a zone part tally item-ized method as one of them.

Usually, although what divides the signal on a time-axis into the partial zone of the

plurality still on a time-axis with a filter and is coded is called a zone part tally item-sized method. What is called an orthogonal-transformation-encoding method that changes the signal on a time-axis into the signal on a frequency axis (rectangular change) and is divided and coded to two or more partial zones is also a kind of zone part tally item-sized method.

[0003] As a filter for the above-mentioned zone division, digital filters such as a polyphase filter bank and QMF filter are mentioned for example. Fast Fourier Transform (FFT), a discrete cosine transform (DCT) etc. are mentioned as orthogonal transformation for example.

[0004] When coding the sample data for every partial zone divided into two or more partial zones, the coding by accommodative bit assignment is performed for every predetermined bit distribution or partial zone for every partial zone.

[0005] As such a coding mode, there are some which were shown for example in JP04-177300A and JP05-37396A. Drawing 27 is a figure showing the composition of the above conventional encoders. As for an auditory model part and 4a zone dividing part and 2 are [ a quantizing part and 6 ] multiplexing parts, a bit assigning part and 5 a maximum primary detecting element and 3 1.

[0006] Operation of the conventional encoder shown in drawing 27 is explained. In the zone dividing part 1, an input signal is divided into two or more partial zones and the partial zone signal over a certain specific time division is outputted. In coding of an audible signal according to human being's aural characteristic, it usually divides into the equal bandwidth of 32 pieces. In specific time division, the maximum of the absolute value of a partial zone signal is detected for every partial zone in the maximum primary detecting element 2. In the auditory model part 3, the valuation function for conducting spectrum analysis of FFT analysis etc. and analyzing an input signal based on human being's aural characteristic to this further and performing optimal bit assignment by the bit assigning part 4 in consideration of the maximum from the maximum primary detecting element 2 is computed. The aural characteristics of human being who says here are mainly lower limit of hearing and a masking effect. Lower limit of hearing is a minimum level which can be perceived by human being's acoustic sense and a masking effect is a phenomenon it becomes impossible to perceive the signal of a small level with the signal of a big level. In consideration of these characteristics, a valuation function is computed from the spectrum and the relation of the mask characteristic of an input signal ingredient. There is a difference of the maximum of the signal level in each partial zone and the minimum of the mask characteristic as an example of a valuation function.

[0007] In the bit assigning part 4, the optimal bit assignment for each partial zone is determined based on the valuation function from the auditory model part 3. When the difference of the maximum of a signal level and the minimum of the mask characteristic is considered as a valuation function, a bit is assigned one by one from the big partial zone of the difference. When using such a valuation function and this value serves as negative, the control which makes bit assignment zero in consideration of the efficiency of coding may be added. In the quantizing part 5, the partial zone signal of each partial zone from the zone dividing part 1 is normalized at the maximum from the maximum primary detecting element 2 in order to raise quantization efficiency and it quantizes and codes according to the bit assignment from the bit assigning part 4. The multiplexing part 6 multiplexes the maximum information from the maximum primary detecting element



the bit quota information from the bit assigning part 4 and the sample information from the quantizing part 5 and outputs them as coding data. In this case when the bit assignment to a partial zone is zero because of amount-of-information reduction the maximum information and sample information over that partial zone are not usually multiplexed.

[0008] Drawing 28 simplifies and expresses the power distribution of a partial zone signal. Drawing 29 shows the situation of the bit assignment assigned by the bit assigning part 4. The information is not transmitted when the bit assignment of each partial zone signal shown in drawing 28 is zero. Therefore the partial zone signal transmitted when the bit assignment shown in drawing 29 is assigned becomes like drawing 30.

[0009] Drawing 31 is a figure showing the composition of the conventional decoder. As for 1 an inverse quantization part and 3 are band composition parts a separation part and 2. The inputted coding data is divided into sample information maximum information and bit quota information in the separation part 1. Bit assignment decodes the partial zone signal for every partial zone which is not zero from each information and bit assignment substitutes the inverse quantization part 2 for a zero signal as a partial zone signal to the partial zone which is zero and carries out band composition of these partial zone signals to the signal of the original bandwidth in the band composition part 3 at it.

[0010]

[Problem(s) to be Solved by the Invention] In such a conventional encoder and decoder divide the HARASHIN item into two or more partial zones and transmission processing of each partial zone signaling information is carried out. When the bit assigned to a certain partial zone was zero the partial zone signaling information for example the above-mentioned maximum information and sample information will be transmitted and so the decoded signal compounded after transmission had the problem that power decreased to the HARASHIN item.

[0011] Were made in order that this invention might solve the above technical problems and transmission of required partial zone signaling information is guaranteed. Or when the power for partial zone signal loss is compensated beforehand or compensation etc. carry out power for partial zone signal loss afterwards it aims at providing the coding decoder which acquires a coding decoded signal without a signal power loss from the HARASHIN item.

[0012]

[Means for Solving the Problem] An encoder concerning claim 1 of this invention is characterized by comprising:

A zone division means to divide an input signal into two or more partial zones and to generate two or more partial zone signals.

An auditory model means to conduct spectrum analysis of the above-mentioned input signal based on a masking rule of human being's aural characteristic and to compute a valuation function over two or more above-mentioned partial zones.

A reference bit quota table which memorizes predetermined reference bit quota information to the above-mentioned partial zone.

Based on a valuation function computed by reference bit quota information and the above-mentioned auditory model means of the above-mentioned reference bit quota table a bit quota means to generate bit quota information for quantizing two or more partial zone signals generated by the above-mentioned zone division means and a quantization means which quantizes two or more partial zone signals generated by the

above-mentioned zone division means based on bit quota information generated by the above-mentioned bit quota means.

[0013]An encoder concerning claim 2 of this invention is characterized by comprising:

A zone division means to divide an input signal into two or more partial zonesand to generate two or more partial zone signals.

A power calculating means which computes power of two or more partial zone signals generated by the above-mentioned zone division means.

An auditory model means to conduct spectrum analysis of the above-mentioned input signal based on a masking rule of human being's aural characteristicand to compute a valuation function over two or more above-mentioned partial zones.

A reference bit quota table which outputs predetermined reference bit quota information to a partial zone based on calculation power of a partial zone of the above-mentioned power calculating meansA bit quota means to generate bit quota information for quantizing two or more partial zone signals generated by the above-mentioned zone division means based on a valuation function computed by reference bit quota information and the above-mentioned auditory model means of the above-mentioned reference bit quota tableA quantization means which quantizes two or more partial zone signals generated by the above-mentioned zone division means based on bit quota information determined by the above-mentioned bit quota means.

[0014]An encoder concerning claim 3 of this invention is characterized by comprising:

A zone division means to divide an input signal into two or more partial zonesand to generate two or more partial zone signals.

An auditory model means to conduct spectrum analysis of the above-mentioned input signal based on a masking rule of human being's aural characteristicand to compute a valuation function over two or more above-mentioned partial zones.

A reference bit quota table which outputs predetermined reference bit quota information over a partial zone based on a spectrum-analysis result of the above-mentioned auditory model means.

A bit quota means to generate bit assignment for quantizing two or more partial zone signals generated by the above-mentioned zone division means based on a valuation function computed by reference bit quota information and the above-mentioned auditory model means of the above-mentioned reference bit quota tableA quantization means which quantizes two or more partial zone signals generated by the above-mentioned zone division means based on bit quota information determined by the above-mentioned bit quota means.

[0015]An encoder concerning claim 4 of this invention is characterized by comprising:

A zone division means to divide an input signal into two or more partial zonesand to generate two or more partial zone signals.

A maximum value detecting means which detects the maximum of two or more partial zone signals generated by the above-mentioned zone division means.

An auditory model means to conduct spectrum analysis of the above-mentioned input signal based on a masking rule of human being's aural characteristicand to compute a valuation function over two or more above-mentioned partial zones.

A reference bit quota table which memorizes predetermined reference bit quota information over a partial zone based on the maximum detected by the above-mentioned maximum value detecting means  
 A bit quota means to generate bit assignment for quantizing two or more partial zone signals generated by the above-mentioned zone division means based on a valuation function computed by reference bit quota information and the above-mentioned auditory model means of the above-mentioned reference bit quota table  
 A quantization means which quantizes two or more partial zone signals generated by the above-mentioned zone division means based on bit quota information determined by the above-mentioned bit quota means.

[0016] A zone division means for an encoder concerning claim 5 of this invention to divide an input signal into two or more partial zones and to generate two or more partial zone signals  
 An auditory model means to conduct spectrum analysis of the above-mentioned input signal based on a masking rule of human being's aural characteristic and to compute a valuation function over two or more above-mentioned partial zones  
 A reference bit quota table which memorizes predetermined reference bit quota information over the above-mentioned partial zone  
 A bit quota means to generate bit assignment for quantizing two or more partial zone signals generated by the above-mentioned zone division means based on a valuation function computed by reference bit quota information and the above-mentioned auditory model means of the above-mentioned reference bit quota table  
 A quantization means which quantizes two or more partial zone signals generated by the above-mentioned zone division means based on bit quota information determined by the above-mentioned bit quota means  
 A local decoding means to decode coding data quantized by the above-mentioned quantization means  
 In [ have the 1st power tools of analysis that computes power and spectrum of the above-mentioned input signal and the 2nd power tools of analysis that computes power and spectrum of a decoded signal which were decoded by the above-mentioned local decoding means and ] the above-mentioned reference bit quota means  
 From a result of power tools of analysis of the above 1st and the 2nd power tools of analysis predetermined reference bit quota information is outputted in consideration of a power loss when bit assignment to a partial zone decreases.

[0017] An encoder concerning claim 6 of this invention is characterized by comprising:

A zone division means to divide an input signal into two or more partial zones and to generate two or more partial zone signals.

An auditory model means to conduct spectrum analysis of the input signal based on a masking rule of human being's aural characteristic and to compute a valuation function over two or more above-mentioned partial zones.

A bit quota means to generate bit quota information for quantizing two or more partial zone signals generated by the above-mentioned zone division means.

A quantization means which quantizes two or more partial zone signals generated by the above-mentioned zone division means based on bit quota information determined by the above-mentioned bit quota means  
 A power calculating means which asks for power of a partial zone signal of the above-mentioned zone division means and an adjustment device which adjusts a gain of an input signal corresponding to power of a partial zone searched for by the above-mentioned power calculating means.

[0018]An encoder concerning claim 7 of this invention is characterized by comprising:

A zone division means to divide an input signal into two or more partial zones and to generate two or more partial zone signals.

A maximum value detecting means which detects the maximum of an absolute value of two or more partial zone signals generated by the above-mentioned zone division means.

An auditory model means to conduct spectrum analysis of the input signal based on a masking rule of human being's aural characteristic and to compute a valuation function over two or more above-mentioned partial zones.

A bit quota means to generate bit quota information for quantizing two or more partial zone signals generated by the above-mentioned zone division means. A quantization means which quantizes two or more partial zone signals generated by the above-mentioned zone division means based on bit quota information defined by the above-mentioned bit quota means. An adjustment device which adjusts a gain of the maximum detected by the above-mentioned maximum value detecting means corresponding to power of a partial zone searched for by power calculating means which asks for power of a partial zone signal of the above-mentioned zone division means and the above-mentioned power calculating means.

[0019]An encoder concerning claim 8 of this invention from bit quota information determined by the above-mentioned bit quota means and power information of a partial zone computed by the above-mentioned power calculating means. In consideration of a power loss when bit assignment to a partial zone becomes zero, a gain adjustment of the biggest maximum is performed among the maximums to each partial zone detected by the above-mentioned maximum value detecting means.

[0020]An encoder concerning claim 9 of this invention takes into consideration a power loss when bit assignment to a partial zone becomes zero from a spectrum analysis result in bit quota information and the above-mentioned auditory model means which were determined by the above-mentioned bit quota means.

[0021]An encoder concerning claim 10 of this invention takes into consideration a power loss when bit assignment to a partial zone becomes zero from the maximum to a partial zone detected by bit assignment determined by the above-mentioned bit quota means and the above-mentioned maximum value detecting means.

[0022]A local decoding means by which an encoder concerning claim 11 of this invention decodes coding data. The 1st power tools of analysis that computes power and spectrum of a signal which were inputted. In [ have the 2nd power tools of analysis that computes power and spectrum of a decoded signal which were decoded by the above-mentioned local decoding means and ] the above-mentioned power calculating means. In [ from a result with power tools of analysis of the above 1st and the 2nd power tools of analysis compute a power loss when bit quota information over a partial zone becomes zero and ] the above-mentioned gain-adjustment means. A gain over an input signal is adjusted according to a power loss computed by the above-mentioned power calculating means.

[0023]A decoder concerning claim 12 of this invention is characterized by comprising: Separating mechanism which separates power information, bit quota information, maximum information, and sample information which are included in inputted coding data.

An inverse quantization means to decode a partial zone signal from the above-mentioned

bit quota informationmaximum informationand sample information.

A band composition means which carries out band composition of the partial zone signal decoded by the above-mentioned inverse quantization means.

A gain-adjustment means to perform a gain adjustment of a decoded signal by which band composition was carried out by the above-mentioned band composition means according to power information separated by separating mechanism.

[0024]A decoder concerning claim 13 of this invention is characterized by comprising:  
Separating mechanism which separates power informationbit quota informationmaximum informationand sample information which are included in inputted coding data.

An inverse quantization means to decode a partial zone signal from the above-mentioned bit quota informationmaximum informationand sample information.

A band composition means which carries out band composition of the partial zone signal decoded by the above-mentioned inverse quantization means.

A power loss calculating means which computes a power loss over a partial zone from power information from the above-mentioned separation partbit quota informationand maximum informationA maximum adjustment device which performs a gain adjustment of maximum information corresponding to a partial zone separated by the above-mentioned separation part according to a power loss computed by the above-mentioned power loss calculating means.

[0025]Separating mechanism which separates bit quota informationmaximum informationand sample information which are included in coding data into which a decoder concerning claim 14 of this invention was inputtedAn inverse quantization means to decode a partial zone signal from the above-mentioned bit quota informationmaximum informationand sample informationA band composition means which carries out band composition of the partial zone signal decoded by the above-mentioned inverse quantization meansA partial zone signal generating means which bit assignment judges a partial zone which is zero from bit quota information separated by the above-mentioned separating mechanismand generates the partial zone signalA calculating means adding a partial zone signal decoded by the above-mentioned inverse quantization meansand a partial zone signal generated by the above-mentioned partial zone signal generating meansIn [ have a band composition means to compound a partial zone signal added by the above-mentioned calculating means to a signal of the original bandwidthand ] the above-mentioned partial zone signal generating meansAs a level of a partial zone signal which bit assignment generates to a partial zone which is zero noise which applied a lower-limit-of-hearing level is generated.

[0026]Separating mechanism which separates bit quota informationmaximum informationand sample information which are included in coding data into which a decoder concerning claim 15 of this invention was inputtedAn inverse quantization means to decode a partial zone signal from the above-mentioned bit quota informationmaximum informationand sample informationA band composition means which carries out band composition of the partial zone signal decoded by the above-mentioned inverse quantization meansA partial zone signal generating means which bit assignment judges a partial zone which is zero from bit quota information separated by the above-mentioned separating mechanismand generates the partial zone signalA

calculating means adding a partial zone signal decoded by the above-mentioned inverse quantization means and a partial zone signal generated by the above-mentioned partial zone signal generating means. In [ have a band composition means to compound a partial zone signal added by the above-mentioned calculating means to a signal of the original bandwidth and ] the above-mentioned partial zone signal generating means. As a level of a partial zone signal which bit assignment generates to a partial zone which is zero, bit assignment generates noise which applied a masking threshold level by a partial zone signal which is not zero from maximum information separated by the above-mentioned separating mechanism.

[0027] Separating mechanism which separates bit quota information, maximum information, and sample information which are included in coding data into which a decoder concerning claim 16 of this invention was inputted. An inverse quantization means to decode a partial zone signal from the above-mentioned bit quota information, maximum information, and sample information. A level information memory measure which memorizes level information of a partial zone signal of the past frame. A band composition means which carries out band composition of the partial zone signal decoded by the above-mentioned inverse quantization means. A partial zone signal generating means which bit assignment judges a partial zone which is zero from bit quota information separated by the above-mentioned separating mechanism and generates the partial zone signal. A calculating means adding a partial zone signal decoded by the above-mentioned inverse quantization means and a partial zone signal generated by the above-mentioned partial zone signal generating means. In [ have a band composition means to compound a partial zone signal added by the above-mentioned calculating means to a signal of the original bandwidth and ] the above-mentioned partial zone signal generating means. Noise which applied a level memorized by the above-mentioned level information memory measure as a level of a partial zone signal which bit assignment generates to a partial zone which is zero is generated.

[0028] Separating mechanism which separates bit quota information, maximum information, and sample information which are included in coding data into which a decoder concerning claim 17 of this invention was inputted. An inverse quantization means to decode a partial zone signal from the above-mentioned bit quota information, maximum information, and sample information. A band composition means which carries out band composition of the partial zone signal decoded by the above-mentioned inverse quantization means. A partial zone signal generating means which bit assignment judges a partial zone which is zero from bit quota information separated by the above-mentioned separating mechanism and generates the partial zone signal. A calculating means adding a partial zone signal decoded by the above-mentioned inverse quantization means and a partial zone signal generated by the above-mentioned partial zone signal generating means. In [ have a band composition means to compound a partial zone signal added by the above-mentioned calculating means to a signal of the original bandwidth and ] the above-mentioned partial zone signal generating means. In the above-mentioned partial zone signal generating means, noise which applied maximum information separated by the above-mentioned separating mechanism as a level of a partial zone signal which bit assignment generates to a partial zone which is zero is generated.

[0029] A decoder concerning claim 18 of this invention has a partial zone signal memory

measure which memorizes a partial zone signal of a frame of the past outputted from the above-mentioned adding means. In the above-mentioned partial zone signal generating means, a partial zone signal of a frame of the past outputted from the above-mentioned partial zone signal memory measure is applied.

[0030] A decoder concerning claim 19 of this invention applies a composite signal of a partial zone signal which contains target harmonic content and subharmonic ingredient of a partial zone among each partial zone signal outputted from the above-mentioned inverse quantization means in the above-mentioned partial zone signal generating means.

[0031]

[Embodiment of the Invention]

an embodiment of the invention -- 1. drawing 1 is shown about the encoder which is an example of this invention. in drawing 1 -- 1 -- as for a bit assigning part and 5 a maximum primary detecting element and 3 are [ a multiplexing part and 8 ] reference bit quota tables a quantizing part and 6 an auditory model part and 4 a zone dividing part and 2. 1-6 are the same as that of the above-mentioned conventional example.

[0032] Next operation is explained. In the zone dividing part 1 an input signal is divided into two or more partial zones and the partial zone signal over a certain specific time division is outputted. In coding of an audible signal according to human being's aural characteristic it usually divides into the equal bandwidth of 32 pieces. In specific time division the maximum of the absolute value of a partial zone signal is detected for every partial zone in the maximum primary detecting element 2. In the auditory model part 3 the valuation function for conducting spectrum analysis of FFT analysis etc. and analyzing an input signal based on human being's aural characteristic to this further and performing optimal bit assignment by the bit assigning part 4 in consideration of the maximum from the maximum primary detecting element 2 is computed. The aural characteristics of human being who says here are mainly lower limit of hearing and a masking effect. Lower limit of hearing is a minimum level which can be perceived by human being's acoustic sense and a masking effect is a phenomenon it becomes impossible to perceive the signal of a small level with the signal of a big level. In consideration of these characteristics a valuation function is computed from the spectrum and the relation of the mask characteristic of an input signal ingredient. There is a difference of the maximum of the signal level in each partial zone and the minimum of the mask characteristic as an example of a valuation function. In the bit assigning part 4 the optimal bit assignment for each partial zone is determined based on the valuation function from the auditory model part 3. In the quantizing part 5 the partial zone signal of each partial zone from the zone dividing part 1 is normalized at the maximum from the maximum primary detecting element 2 in order to raise quantization efficiency and it quantizes and codes according to the bit assignment from the bit assigning part 4. The multiplexing part 6 multiplexes the maximum information from the maximum primary detecting element 2 the bit quota information from the bit assigning part 4 and the sample information from the quantizing part 5 and outputs them as coding data. In this case when the bit assignment to a partial zone is zero because of amount-of-information reduction the maximum information and sample information over that partial zone are not usually multiplexed. In the operation processing of the above coding equipment when quantizing and transmitting a partial zone signal since the information on a partial zone signal that bit assignment is zero is not transmitted at all it cannot carry out decoding reproduction of the partial zone signal in the

decoder side. Therefore as for the reproduced decoded signal the amount of power of the partial zone signal will decrease to the power of the input signal by the side of an encoder. When bit assignment is one or more the information transmission of partial zone signaling information is guaranteed and power does not decrease. If it furthermore says bit assignment will be able to prevent reduction of power with at least 1 bit and the bit assignment beyond it will contribute to the improvement of a quantization noise. The bit assignment from which bit assignment of as opposed to such a partial zone in the reference bit quota table 8 serves as a standard which guarantees power to each partial zone in consideration of the power loss at the time of becoming zero is prepared. For example at least one or more bits are assigned to all the partial zones like drawing 2. If the bit quota table of drawing 2 is used to the input signal which has power distribution like drawing 29 transmission of all the partial zone signals will be guaranteed the partial zone signal transmitted will come to be shown in drawing 29 and the loss of power will not be generated. The rate that the high-frequency component over the signal component of all the zones occupies or a high-frequency component does not exist at all is very small. When characters such as power distribution of an input signal is known beforehand to the high region at least one or more bits are assigned to the zone of zero and others like drawing 3. If the bit quota table of drawing 3 is used to the input signal which has power distribution like drawing 29 the partial zone signal with which transmission is guaranteed comes to be shown in drawing 4 and although the power of the partial zone signal of zero decreases bit assignment. The rate that the decrement all occupies to the power of a quantization region signal is small and there is little influence. In the bit assigning part 4 floor bit assignment for a power guarantee is first performed beforehand based on the reference bit quota table 8. Next based on the valuation function which is outputted from the auditory model part 3 in addition to bit assignment of such a floor bit assignment is further performed to each partial zone for the improvement of a quantization noise. Since one or more bits are assigned to the partial zone whose bit assignment is zero depending on the value of a valuation function on a reference bit quota table at this time it will be further guaranteed about power. The loss of the partial zone signal component by the bit assignment to a partial zone serving as zero by this can be prevented. In the encoder constituted as mentioned above in short a zone division means generates a partial zone signal by dividing an input signal into two or more partial zones. A maximum value detecting means detects the absolute value of a partial zone signal and it an auditory model means spectrum analysis of the input signal is conducted based on the masking rule of human being's aural characteristic. After referring to the reference bit quota table where reference bit assignment at its minimum was beforehand prepared in consideration of the power loss when the valuation function over two or more partial zones is computed and bit assignment of as opposed to a partial zone in a bit quota means becomes zero. Final bit assignment is performed based on a valuation function. a quantization means quantizes two or more partial zone signals based on bit assignment and a multiplexing means multiplexes and outputs bit quota information, maximum detection information and sample information.

[0033] an embodiment of the invention -- 2. drawing 5 is shown about the encoder which is an example of this invention. in drawing 5 -- 1 -- a zone dividing part and 2 -- as for a quantizing part and 6 an auditory model part and 4 are [ a reference bit quota part and 10 ] power calculation parts a multiplexing part and 9 a bit assigning part and 5 a maximum



primary detecting element and 3. 1-6 are the same as that of the above-mentioned conventional example.

[0034]Next operation is explained. In the zone dividing part 1 an input signal is divided into two or more partial zones and the partial zone signal over a certain specific time division is outputted. In coding of an audible signal according to human being's aural characteristic it usually divides into the equal bandwidth of 32 pieces. In specific time division the maximum of the absolute value of a partial zone signal is detected for every partial zone in the maximum primary detecting element 2. In the auditory model part 3 the valuation function for conducting spectrum analysis of FFT analysis etc. and analyzing an input signal based on human being's aural characteristic to this further and performing optimal bit assignment by the bit assigning part 4 in consideration of the maximum from the maximum primary detecting element 2 is computed. The aural characteristics of human being who says here are mainly lower limit of hearing and a masking effect. Lower limit of hearing is a minimum level which can be perceived by human being's acoustic sense and a masking effect is a phenomenon it becomes impossible to perceive the signal of a small level with the signal of a big level. In consideration of these characteristics a valuation function is computed from the spectrum and the relation of the mask characteristic of an input signal ingredient. There is a difference of the maximum of the signal level in each partial zone and the minimum of the mask characteristic as an example of a valuation function. In the bit assigning part 4 the optimal bit assignment for each partial zone is determined based on the valuation function from the auditory model part 3. In the quantizing part 5 the partial zone signal of each partial zone from the zone dividing part 1 is normalized at the maximum from the maximum primary detecting element 2 in order to raise quantization efficiency and it quantizes and codes according to the bit assignment from the bit assigning part 4. The multiplexing part 6 multiplexes the maximum information from the maximum primary detecting element 2 the bit quota information from the bit assigning part 4 and the sample information from the quantizing part 5 and outputs them as coding data. In this case when the bit assignment to a partial zone is zero because of amount-of-information reduction the maximum information and sample information over that partial zone are not usually multiplexed. In the operation processing of the above encoder when quantizing and transmitting a partial zone signal since the information on a partial zone signal that bit assignment is zero is not transmitted at all it cannot carry out decoding reproduction of the partial zone signal in the decoder side. Therefore as for the reproduced decoded signal the amount of power of the partial zone signal will decrease to the power of the input signal by the side of an encoder. When bit assignment is one or more the information transmission of partial zone signaling information is guaranteed and power does not decrease. If it furthermore says bit assignment will be able to prevent reduction of power with at least 1 bit and the bit assignment beyond it will contribute to the improvement of a quantization noise. The bit assignment from which bit assignment of as opposed to such a partial zone in the reference bit quota part 9 serves as a standard which guarantees power to each partial zone in consideration of the power loss at the time of becoming zero is prepared. For example at least one or more bits are assigned to all the partial zones like drawing 2. If the bit quota table of drawing 2 is used to the input signal which has power distribution like drawing 29 transmission of all the partial zone signals will be guaranteed the partial zone signal transmitted will come to be shown in drawing 29 and the loss of power will not be

generated. The rate that the high-frequency component over the signal component of all the zones occupies or a high-frequency component does not exist at all is very small. When characters such as power distribution of an input signal is known beforehand to the high region at least one or more bits are assigned to the zone of zero and others like drawing 3. If the bit assigning part 9 of drawing 3 is used to the input signal which has power distribution like drawing 29 the partial zone signal with which transmission is guaranteed comes to be shown in drawing 4 and although the power of the partial zone signal of zero decreases bit assignment. The decrement has the small rate of all occupying to the power of a zonation region signal and there is little influence. In the bit assigning part 4 floor bit assignment for a power guarantee is first performed beforehand based on the reference bit quota part 9. Next based on the valuation function which is outputted from the auditory model part 3 in addition to bit assignment of such a floor bit assignment is further performed to each partial zone for the improvement of a quantization noise. Since one or more bits are assigned to the partial zone whose bit assignment is zero depending on the value of a valuation function on a reference bit quota table at this time it will be further guaranteed about power. The loss of the partial zone signal component by the bit assignment to a partial zone serving as zero by this can be prevented.

[0035] Next the power calculation part 10 computes power from the partial zone signal of each partial zone outputted from the zone dividing part 1 as power to each partial zone. The reference bit quota part 9 takes into consideration a power loss when the bit assignment to a partial zone becomes zero from the computed result of the power of each partial zone in the power calculation part 10. The method of the consideration is as having stated above. As the result at least one or more bits are assigned for example to all the partial zones. Or a high-frequency component did not exist at all when it is judged that the rate that the high-frequency component over the signal component of all the zones occupies is very small to a high region at least one or more bits are assigned to the zone of zero and others. In the bit assigning part 4 bit assignment is further performed to each partial zone based on the valuation function which is outputted from the auditory model part 3 in addition to bit assignment of the floor for the power guarantee assigned by the reference bit quota part 9 for the improvement of a quantization noise. This can protect the loss of the partial zone signal component by the bit assignment to a partial zone serving as zero corresponding to change of an input signal. In the reference bit quota part 9 arbitrary reference bit assignment may not be performed from a power computed result but it may choose from two or more reference bit quota tables currently prepared beforehand. In short a zone division means generates a partial zone signal by dividing an input signal into two or more partial zones. A power calculating means computes the power of a partial zone signal and it a maximum value detecting means Detect the maximum of the absolute value of a partial zone signal and an auditory model means conducts spectrum analysis of the input signal based on the masking rule of human being's aural characteristic. Compute the valuation function over two or more partial zones and a power loss when the bit assignment to a partial zone becomes zero is taken into consideration from the power information of the partial zone signal with which a reference bit quota means is outputted from a zone division means. Perform bit assignment of a floor and a bit quota means adds to reference bit assignment at its minimum. Final bit assignment is performed based on a valuation function. A quantization means quantizes two or more partial zone signals based on bit assignment and a multiplexing means

multiplexes and outputs bit quota information, maximum detection information and sample information.

[0036]an embodiment of the invention -- 3. drawing 6 is shown about the encoder which is an example of this invention. in drawing 6 -- 1 -- as for a bit assigning part and 5 a maximum primary detecting element and 3 are [ a multiplexing part and 9 ] reference bit quota parts a quantizing part and 6 an auditory model part and 4 a zone dividing part and 2. 1-6 are the same as that of the above-mentioned conventional example.

[0037]Next operation is explained. In the zone dividing part 1 an input signal is divided into two or more partial zones and the partial zone signal over a certain specific time division is outputted. In coding of an audible signal according to human being's aural characteristic it usually divides into the equal bandwidth of 32 pieces. In specific time division the maximum of the absolute value of a partial zone signal is detected for every partial zone in the maximum primary detecting element 2. In the auditory model part 3 the valuation function for conducting spectrum analysis of FFT analysis etc. and analyzing an input signal based on human being's aural characteristic to this further and performing optimal bit assignment by the bit assigning part 4 in consideration of the maximum from the maximum primary detecting element 2 is computed. The aural characteristics of human being who says here are mainly lower limit of hearing and a masking effect. Lower limit of hearing is a minimum level which can be perceived by human being's acoustic sense and a masking effect is a phenomenon it becomes impossible to perceive the signal of a small level with the signal of a big level. In consideration of these characteristics a valuation function is computed from the spectrum and the relation of the mask characteristic of an input signal ingredient. There is a difference of the maximum of the signal level in each partial zone and the minimum of the mask characteristic as an example of a valuation function. In the bit assigning part 4 the optimal bit assignment for each partial zone is determined based on the valuation function from the auditory model part 3. In the quantizing part 5 the partial zone signal of each partial zone from the zone dividing part 1 is normalized at the maximum from the maximum primary detecting element 2 in order to raise quantization efficiency and it quantizes and codes according to the bit assignment from the bit assigning part 4. The multiplexing part 6 multiplexes the maximum information from the maximum primary detecting element 2, the bit quota information from the bit assigning part 4 and the sample information from the quantizing part 5 and outputs them as coding data. In this case when the bit assignment to a partial zone is zero because of amount-of-information reduction the maximum information and sample information over that partial zone are not usually multiplexed. In the operation processing of the above encoder when quantizing and transmitting a partial zone signal since the information on a partial zone signal that bit assignment is zero is not transmitted at all it cannot carry out decoding reproduction of the partial zone signal in the decoder side. Therefore as for the reproduced decoded signal the amount of power of the partial zone signal will decrease to the power of the input signal by the side of an encoder. When bit assignment is one or more the information transmission of partial zone signaling information is guaranteed and power does not decrease. If it furthermore says bit assignment will be able to prevent reduction of power with at least 1 bit and the bit assignment beyond it will contribute to the improvement of a quantization noise. The bit assignment from which bit assignment of as opposed to such a partial zone in the reference bit quota part 9 serves as a standard which guarantees power to each partial

zone in consideration of the power loss at the time of becoming zero is prepared. For example at least one or more bits are assigned to all the partial zones like drawing 2. If the bit quota table of drawing 2 is used to the input signal which has power distribution like drawing 29 transmission of all the partial zone signals will be guaranteed the partial zone signal transmitted will come to be shown in drawing 29 and the loss of power will not be generated. The rate that the high-frequency component over the signal component of all the zones occupies or a high-frequency component does not exist at all is very small. When characters such as power distribution of an input signal is known beforehand to the high region at least one or more bits are assigned to the zone of zero and others like drawing 3. If the bit assigning part 9 of drawing 3 is used to the input signal which has power distribution like drawing 29 the partial zone signal with which transmission is guaranteed comes to be shown in drawing 4 and although the power of the partial zone signal of zero decreases bit assignment. The rate that the decrement all occupies to the power of a zonation region signal is small and there is little influence. In the bit assigning part 4 bit assignment of the floor for a power guarantee is first performed beforehand based on the reference bit quota part 9. Next based on the valuation function which is outputted from the auditory model part 3 in addition to bit assignment of such a floor bit assignment is further performed to each partial zone for the improvement of a quantization noise. Since one or more bits are assigned to the partial zone whose bit assignment is zero depending on the value of a valuation function on a reference bit quota table at this time it will be further guaranteed about power. The loss of the partial zone signal component by the bit assignment to a partial zone serving as zero by this can be prevented.

[0038] Below the reference bit quota part 9 is explained in detail. The reference bit quota part 9 computes the power of each partial zone from the result of the spectrum analysis in the auditory model part 3 and takes into consideration a power loss when the bit assignment to a partial zone becomes zero. The method of the consideration is as having stated above. As the result at least one or more bits are assigned for example to all the partial zones. Or a high-frequency component did not exist at all when it is judged that the rate that the high-frequency component over the signal component of all the zones occupies is very small to a high region at least one or more bits are assigned to the zone of zero and others. In the bit assigning part 4 bit assignment is further performed to each partial zone based on the valuation function which is outputted from the auditory model part 3 in addition to bit assignment of the floor for the power guarantee assigned by the reference bit quota part 9 for the improvement of a quantization noise. This can protect the loss of the partial zone signal component by the bit assignment to a partial zone serving as zero corresponding to change of an input signal. In the reference bit quota part 9 arbitrary reference bit assignment may not be performed but it may choose from two or more reference bit quota tables which exist above and which are prepared beforehand. In short a zone division means generates a partial zone signal by dividing an input signal into two or more partial zones. A power calculating means computes the power of a partial zone signal and it a maximum value detecting means Detect the maximum of the absolute value of a partial zone signal and an auditory model means conducts spectrum analysis of the input signal based on the masking rule of human being's aural characteristic. Compute the valuation function over two or more partial zones and a power loss when the bit assignment to a partial zone becomes zero is taken

into consideration from a spectrum analysis result [ in / in a reference bit quota means / an auditory model means ]Perform bit assignment of a floor and a bit quota means adds to reference bit assignment at its minimumFinal bit assignment is performed based on a valuation functiona quantization means quantizes two or more partial zone signals based on bit assignmentand a multiplexing means multiplexes and outputs bit quota informationmaximum detection informationand sample information.

[0039]an embodiment of the invention -- 4. drawing 7 is shown about the encoder which is one example of this invention. In drawing 71-6 are the same as that of the above-mentioned conventional exampleand they omit the explanation. 9 is a reference bit quota part.

[0040]Nextoperation is explained. In the zone dividing part 1an input signal is divided into two or more partial zonesand the partial zone signal over a certain specific time division is outputted. In coding of an audible signalaccording to human being's aural characteristicit usually divides into the equal bandwidth of 32 pieces. In specific time divisionthe maximum of the absolute value of a partial zone signal is detected for every partial zone in the maximum primary detecting element 2. In the auditory model part 3the valuation function for conducting spectrum analysis of FFT analysis etc.and analyzing an input signal based on human being's aural characteristic to this furtherand performing optimal bit assignment by the bit assigning part 4 in consideration of the maximum from the maximum primary detecting element 2 is computed. The aural characteristics of human being who says here are mainly lower limit of hearing and a masking effect. Lower limit of hearing is a minimum level which can be perceived by human being's acoustic senseand a masking effect is a phenomenon it becomes impossible to perceive the signal of a small level with the signal of a big level. In consideration of these characteristicsa valuation function is computed from the spectrum and the relation of the mask characteristic of an input signal ingredient. There is a difference of the maximum of the signal level in each partial zone and the minimum of the mask characteristic as an example of a valuation function. In the bit assigning part 4the optimal bit assignment for each partial zone is determined based on the valuation function from the auditory model part 3. In the quantizing part 5the partial zone signal of each partial zone from the zone dividing part 1 is normalized at the maximum from the maximum primary detecting element 2in order to raise quantization efficiencyand it quantizes and codes according to the bit assignment from the bit assigning part 4. The multiplexing part 6 multiplexes the maximum information from the maximum primary detecting element 2the bit quota information from the bit assigning part 4and the sample information from the quantizing part 5and outputs them as coding data. In this casewhen the bit assignment to a partial zone is zero because of amount-of-information reductionthe maximum information and sample information over that partial zone are not usually multiplexed. In the operation processing of the above encoderwhen quantizing and transmitting a partial zone signalsince the information on a partial zone signal that bit assignment is zero is not transmitted at allit cannot carry out decoding reproduction of the partial zone signal in the decoder side. Thereforeas for the reproduced decoded signalthe amount of power of the partial zone signal will decrease to the power of the input signal by the side of an encoder. When bit assignment is one or morethe information transmission of partial zone signaling information is guaranteedand power does not decrease. If it furthermore saysbit assignment will be able to prevent reduction of power with at least 1 bitand the bit

assignment beyond it will contribute to the improvement of a quantization noise. The bit assignment from which bit assignment of as opposed to such a partial zone in the reference bit quota part 9 serves as a standard which guarantees power to each partial zone in consideration of the power loss at the time of becoming zero is prepared. For example at least one or more bits are assigned to all the partial zones like drawing 2. If the bit assigning part of drawing 2 is used to the input signal which has power distribution like drawing 29 transmission of all the partial zone signals will be guaranteed the partial zone signal transmitted will come to be shown in drawing 29 and the loss of power will not be generated. The rate that the high-frequency component over the signal component of all the zones occupies or a high-frequency component does not exist at all is very small. When characters such as power distribution of an input signal is known beforehand to the high region at least one or more bits are assigned to the zone of zero and others like drawing 3. If the bit quota table of drawing 3 is used to the input signal which has power distribution like drawing 29 the partial zone signal with which transmission is guaranteed comes to be shown in drawing 4 and although the power of the partial zone signal of zero decreases bit assignment. The rate that the decrement all occupies to the power of a quantization region signal is small and there is little influence. In the bit assigning part 4 bit assignment of the floor for a power guarantee is first performed beforehand based on the reference bit quota part 9. Next based on the valuation function which is outputted from the auditory model part 3 in addition to bit assignment of such a floor bit assignment is further performed to each partial zone for the improvement of a quantization noise. Since one or more bits are assigned to the partial zone whose bit assignment is zero depending on the value of a valuation function on a reference bit quota table at this time it will be further guaranteed about power. The loss of the partial zone signal component by the bit assignment to a partial zone serving as zero by this can be prevented.

[0041] Below the reference bit quota part 9 is explained in detail. The reference bit quota part 9 computes the power of each partial zone from the maximum of the absolute value of the sample data of each partial zone outputted from the maximum primary detecting element 2 and takes into consideration a power loss when the bit assignment to a partial zone becomes zero. The method of the consideration is as having stated above. As the result at least one or more bits are assigned for example to all the partial zones. Or a high-frequency component did not exist at all when it is judged that the rate that the high-frequency component over the signal component of all the zones occupies is very small to a high region at least one or more bits are assigned to the zone of zero and others. In the bit assigning part 4 bit assignment is further performed to each partial zone based on the valuation function which is outputted from the auditory model part 3 in addition to bit assignment of the floor for the power guarantee assigned by the reference bit quota part 9 for the improvement of a quantization noise. This can protect the loss of the partial zone signal component by the bit assignment to a partial zone serving as zero corresponding to change of an input signal. In the reference bit quota part 9 arbitrary reference bit assignment may not be performed from a power computed result but it may choose from two or more reference bit quota tables currently prepared beforehand. In short a zone division means generates a partial zone signal by dividing an input signal into two or more partial zones. A power calculating means computes the power of a partial zone signal and it a maximum value detecting means Detect the maximum of the absolute value of a partial zone signal and an auditory model means conducts spectrum analysis of

the input signal based on the masking rule of human being's aural characteristic. Compute the valuation function over two or more partial zones and a power loss when the bit assignment to a partial zone becomes zero is taken into consideration from the size of the maximum [in / in a reference bit quota means / a maximum value detecting means]. Perform bit assignment of a floor and a bit quota means adds to reference bit assignment at its minimum. Final bit assignment is performed based on a valuation function. A quantization means quantizes two or more partial zone signals based on bit assignment and a multiplexing means multiplexes and outputs bit quota information, maximum detection information, and sample information.

[0042] an embodiment of the invention -- 5. drawing 8 is shown about the encoder which is one example of this invention. In drawing 8 1-6 are the same as that of the above-mentioned conventional example and they omit the explanation. As for 9a local decoding section and 12 and 13 are power analyzer or a reference bit quota part and 11.

[0043] Next operation is explained. In the zone dividing part 1 an input signal is divided into two or more partial zones and the partial zone signal over a certain specific time division is outputted. In coding of an audible signal according to human being's aural characteristic it usually divides into the equal bandwidth of 32 pieces. In specific time division the maximum of the absolute value of a partial zone signal is detected for every partial zone in the maximum primary detecting element 2. In the auditory model part 3 the valuation function for conducting spectrum analysis of FFT analysis etc. and analyzing an input signal based on human being's aural characteristic to this further and performing optimal bit assignment by the bit assigning part 4 in consideration of the maximum from the maximum primary detecting element 2 is computed. The aural characteristics of human being who says here are mainly lower limit of hearing and a masking effect. Lower limit of hearing is a minimum level which can be perceived by human being's acoustic sense and a masking effect is a phenomenon it becomes impossible to perceive the signal of a small level with the signal of a big level. In consideration of these characteristics a valuation function is computed from the spectrum and the relation of the mask characteristic of an input signal ingredient. There is a difference of the maximum of the signal level in each partial zone and the minimum of the mask characteristic as an example of a valuation function. In the bit assigning part 4 the optimal bit assignment for each partial zone is determined based on the valuation function from the auditory model part 3. In the quantizing part 5 the partial zone signal of each partial zone from the zone dividing part 1 is normalized at the maximum from the maximum primary detecting element 2 in order to raise quantization efficiency and it quantizes and codes according to the bit assignment from the bit assigning part 4. The multiplexing part 6 multiplexes the maximum information from the maximum primary detecting element 2, the bit quota information from the bit assigning part 4 and the sample information from the quantizing part 5 and outputs them as coding data. In this case when the bit assignment to a partial zone is zero because of amount-of-information reduction the maximum information and sample information over that partial zone are not usually multiplexed. In the operation processing of the above encoder when quantizing and transmitting a partial zone signal since the information on a partial zone signal that bit assignment is zero is not transmitted at all it cannot carry out decoding reproduction of the partial zone signal in the decoder side. Therefore as for the reproduced decoded signal the amount of power of the partial zone signal will decrease to the power of the input signal by the side of an encoder.

When bit assignment is one or more the information transmission of partial zone signaling information is guaranteed and power does not decrease. If it furthermore says bit assignment will be able to prevent reduction of power with at least 1 bit and the bit assignment beyond it will contribute to the improvement of a quantization noise. The bit assignment from which bit assignment of as opposed to such a partial zone in the reference bit quota part 9 serves as a standard which guarantees power to each partial zone in consideration of the power loss at the time of becoming zero is prepared. For example at least one or more bits are assigned to all the partial zones like drawing 2. If the bit assigning part 9 of drawing 2 is used to the input signal which has power distribution like drawing 29 transmission of all the partial zone signals will be guaranteed the partial zone signal transmitted will come to be shown in drawing 29 and the loss of power will not be generated. The rate that the high-frequency component over the signal component of all the zones occupies or a high-frequency component does not exist at all is very small. When characters such as power distribution of an input signal is known beforehand to the high region at least one or more bits are assigned to the zone of zero and others like drawing 3. If the bit assigning part 9 of drawing 3 is used to the input signal which has power distribution like drawing 29 the partial zone signal with which transmission is guaranteed comes to be shown in drawing 4 and although the power of the partial zone signal of zero decreases bit assignment. The decrement has the small rate of all occupying to the power of a zonation region signal and there is little influence. In the bit assigning part 4 floor bit assignment for a power guarantee is first performed beforehand based on the reference bit quota part 9. Next based on the valuation function which is outputted from the auditory model part 3 in addition to bit assignment of such a floor bit assignment is further performed to each partial zone for the improvement of a quantization noise. Since one or more bits are assigned to the partial zone whose bit assignment is zero depending on the value of a valuation function on a reference bit quota table at this time it will be further guaranteed about power. The loss of the partial zone signal component by the bit assignment to a partial zone serving as zero by this can be prevented.

[0044] Next the bit assigning part 4 once performs bit assignment to each partial zone based on the valuation function outputted from the auditory model part 3. In the quantizing part 5 quantization is performed based on this bit assignment and a variety of information multiplexes in the multiplexing part 6. The local decoding part 11 is the same composition as the decoder shown in a conventional example and operates the order of a foul trick of processing with an encoder i.e. separation of coding data in inverse quantization band composition etc. The local decoding part 11 inputs the coding data outputted from the multiplexing part 6 processes the point and outputs a decoded signal. The 1st power analyzer 12 computes the power and spectrum of an input HARASHIN item which are inputted into an encoder and the 2nd power analyzer 13 computes the power and spectrum of a decoded signal which are outputted from the local decoding part 11. The reference bit quota part 9 takes the loss of the power in coding into consideration from the power analysis result outputted from the 1st power analyzer 12 and the 2nd power analyzer 13. The method of the consideration is as having stated above. In order to prevent the loss of power as the result at least one or more bits are assigned for example to all the partial zones. Or a high-frequency component did not exist at all when it is judged that the rate that the high-frequency component over the signal component of all the zones occupies is very small to a high region at least one or more bits are assigned to the



zone of zero and others. In the bit assigning part 4 bit assignment is again performed to each partial zone based on the valuation function which is outputted from the auditory model part 3 in addition to bit assignment of the floor for the power guarantee assigned by the reference bit quota part 9 for the improvement of a quantization noise. This can protect the loss of the partial zone signal component by the bit assignment to a partial zone serving as zero corresponding to change of an input signal. In the reference bit quota part 9 arbitrary reference bit assignment may not be performed from a power computed result but it may choose from two or more reference bit quota tables currently prepared beforehand. In short a zone division means generates a partial zone signal by dividing an input signal into two or more partial zones again. A power calculating means computes the power of a partial zone signal and a maximum value detecting means detects the maximum of the absolute value of a partial zone signal and an auditory model means conducts spectrum analysis of the input signal based on the masking rule of human being's aural characteristic. Compute the valuation function over two or more partial zones and a power loss when bit assignment of as opposed to a partial zone in a reference bit quota means becomes zero is taken into consideration from the power analysis result of an input signal and a decoded signal. Perform bit assignment of a floor and a bit quota means adds to reference bit assignment at its minimum. Based on a valuation function perform final bit assignment and a quantization means quantizes two or more partial zone signals based on bit assignment. A multiplexing means multiplexes and outputs bit quota information, maximum detection information and sample information. A local decoding machine generates a decoded signal. the 1st power tools of analysis compute the power and spectrum of an input signal and the 2nd power tools of analysis compute the power and spectrum of a decoded signal.

[0045] an embodiment of the invention -- 6. drawing 9 is shown about the encoder which is an example of this invention. In drawing 9 1-6 are the same as that of the above-mentioned conventional example and they omit the explanation. 14 is a power loss calculation part and 15 is a gain adjustment part.

[0046] Next operation is explained. In the zone dividing part 1 an input signal is divided into two or more partial zones and the partial zone signal over a certain specific time division is outputted. In coding of an audible signal according to human being's aural characteristic it usually divides into the equal bandwidth of 32 pieces. In specific time division the maximum of the absolute value of a partial zone signal is detected for every partial zone in the maximum primary detecting element 2. In the auditory model part 3 the valuation function for conducting spectrum analysis of FFT analysis etc. and analyzing an input signal based on human being's aural characteristic to this further and performing optimal bit assignment by the bit assigning part 4 in consideration of the maximum from the maximum primary detecting element 2 is computed. The aural characteristics of human being who says here are mainly lower limit of hearing and a masking effect. Lower limit of hearing is a minimum level which can be perceived by human being's acoustic sense and a masking effect is a phenomenon it becomes impossible to perceive the signal of a small level with the signal of a big level. In consideration of these characteristics a valuation function is computed from the spectrum and the relation of the mask characteristic of an input signal ingredient. There is a difference of the maximum of the signal level in each partial zone and the minimum of the mask characteristic as an example of a valuation function. In the bit assigning part 4 the optimal bit assignment for

each partial zone is determined based on the valuation function from the auditory model part 3. In the quantizing part 5 the partial zone signal of each partial zone from the zone dividing part 1 is normalized at the maximum from the maximum primary detecting element 2 in order to raise quantization efficiency and it quantizes and codes according to the bit assignment from the bit assigning part 4. The multiplexing part 6 multiplexes the maximum information from the maximum primary detecting element 2, the bit quota information from the bit assigning part 4 and the sample information from the quantizing part 5 and outputs them as coding data. In this case when the bit assignment to a partial zone is zero because of amount-of-information reduction, the maximum information and sample information over that partial zone are not usually multiplexed. In the operation processing of the above encoder when quantizing and transmitting a partial zone signal since the information on a partial zone signal that bit assignment is zero is not transmitted at all, it cannot carry out decoding reproduction of the partial zone signal in the decoder side. Therefore as for the reproduced decoded signal, the amount of power of the partial zone signal will decrease to the power of the input signal by the side of an encoder. When bit assignment is one or more, the information transmission of partial zone signaling information is guaranteed and power does not decrease. If it furthermore says bit assignment will be able to prevent reduction of power with at least 1 bit and the bit assignment beyond it will contribute to the improvement of a quantization noise.

Next, the zone dividing part 1, the maximum primary detecting element 2, the auditory model part 3 and the bit assigning part 4 so once process to an input signal. The power loss calculation part 14 computes the power of a partial zone signal to the partial zone signal of each partial zone outputted from the zone dividing part 1. It distinguishes whether the bit assignment to each partial zone is zero from the bit assignment simultaneously determined by the bit assigning part 4 and bit assignment computes the sum total of the power of the partial zone which is zero. Drawing 10 is a situation of the power of a partial zone signal. The slash part in a figure expresses the power of the partial zone from which bit assignment became zero and this serves as a power loss. The gain adjustment part 15 adjusts the gain of an input signal towards compensating the loss according to the power computed by the power loss calculation part 14. The usual processing is performed to the input signal adjusted by this gain adjustment part 15 after that. Since the input signal in this case has performed the gain adjustment, power is increasing to the level in which the power of the partial zone signal in the power loss calculation part 14 is shown by the dotted line in drawing 10. This dotted-line portion is equal to the power of a shadow area and the loss of the partial zone signal component by the bit assignment to a partial zone serving as zero by this can be beforehand compensated with the encoder side.

In short, a zone division means generates a partial zone signal by dividing an input signal into two or more partial zones. A maximum value detecting means detects the maximum of the absolute value of a partial zone signal and it an auditory model means Based on the masking rule of human being's aural characteristic conduct spectrum analysis of the input signal, compute the valuation function over two or more partial zones and a bit quota means as bit assignment for quantizing two or more partial zone signals. Based on a valuation function perform bit assignment and a quantization means quantizes two or more partial zone signals based on bit assignment. A multiplexing means multiplexes and outputs bit quota information, maximum detection information and sample information. From the bit assignment by the power and the bit

quota means of a partial zone signal which a power loss calculating means is outputted from a zone division means a power loss when the bit assignment to a partial zone becomes zero is computed and a gain adjustment part performs the gain adjustment of an input signal according to a power loss.

[0047]an embodiment of the invention -- 7. drawing 11 is shown about the encoder which is one example of this invention. In drawing 11 1-6 are the same as that of the above-mentioned conventional example and they omit the explanation. 14 is a power loss calculation part and 16 is a maximum controller. Next operation is explained.

[0048]Next operation is explained. In the zone dividing part 1 an input signal is divided into two or more partial zones and the partial zone signal over a certain specific time division is outputted. In coding of an audible signal according to human being's aural characteristic it usually divides into the equal bandwidth of 32 pieces. In specific time division the maximum of the absolute value of a partial zone signal is detected for every partial zone in the maximum primary detecting element 2. In the auditory model part 3 the valuation function for conducting spectrum analysis of FFT analysis etc. and analyzing an input signal based on human being's aural characteristic to this further and performing optimal bit assignment by the bit assigning part 4 in consideration of the maximum from the maximum primary detecting element 2 is computed. The aural characteristics of human being who says here are mainly lower limit of hearing and a masking effect. Lower limit of hearing is a minimum level which can be perceived by human being's acoustic sense and a masking effect is a phenomenon it becomes impossible to perceive the signal of a small level with the signal of a big level. In consideration of these characteristics a valuation function is computed from the spectrum and the relation of the mask characteristic of an input signal ingredient. There is a difference of the maximum of the signal level in each partial zone and the minimum of the mask characteristic as an example of a valuation function. In the bit assigning part 4 the optimal bit assignment for each partial zone is determined based on the valuation function from the auditory model part 3. In the quantizing part 5 the partial zone signal of each partial zone from the zone dividing part 1 is normalized at the maximum from the maximum primary detecting element 2 in order to raise quantization efficiency and it quantizes and codes according to the bit assignment from the bit assigning part 4. The multiplexing part 6 multiplexes the maximum information from the maximum primary detecting element 2 the bit quota information from the bit assigning part 4 and the sample information from the quantizing part 5 and outputs them as coding data. In this case when the bit assignment to a partial zone is zero because of amount-of-information reduction the maximum information and sample information over that partial zone are not usually multiplexed. In the operation processing of the above encoder when quantizing and transmitting a partial zone signal since the information on a partial zone signal that bit assignment is zero is not transmitted at all it cannot carry out decoding reproduction of the partial zone signal in the decoder side. Therefore as for the reproduced decoded signal the amount of power of the partial zone signal will decrease to the power of the input signal by the side of an encoder. When bit assignment is one or more the information transmission of partial zone signaling information is guaranteed and power does not decrease. If it furthermore says bit assignment will be able to prevent reduction of power with at least 1 bit and the bit assignment beyond it will contribute to the improvement of a quantization noise. The power loss calculation part 14 computes the power of a partial zone signal to the partial

zone signal of each partial zone outputted from the zone dividing part 1. It distinguishes whether the bit assignment to each partial zone is zero from the bit assignment simultaneously determined by the bit assigning part 4 and bit assignment computes the sum total of the power of the partial zone which is zero. This is the power loss by bit assignment being zero. The maximum controller 16 performs the gain adjustment of the maximum to all the partial zones detected by the maximum primary detecting element 2 towards compensating the loss according to the power loss computed by the power loss calculation part 14. To all the partial zones this gain adjustment may be an equal or may make weighting a gain. In the quantizing part 5 since the maximum which normalization is performed using the maximum outputted from the maximum primary detecting element 2 and is outputted from the maximum controller 16 as maximum information transmitted and by which the gain adjustment was carried out is used when performing reverse normalization by the decoder side a gain will be given to a partial zone signal. The situation is shown in drawing 12. After normalizing a certain partial zone signal at the maximum if a gain adjustment is performed to the maximum and reverse normalization is carried out amplitude will be amplified and the power of a partial zone signal will also increase as a result. By this operation the power loss by bit assignment being zero is compensated by making the power of all the partial zones increase. The loss of the partial zone signal component by the bit assignment to a partial zone serving as zero by this can be beforehand compensated with the encoder side. In short a zone division means generates a partial zone signal by dividing an input signal into two or more partial zones again. A maximum value detecting means detects the maximum of the absolute value of a partial zone signal and it an auditory model means Based on the masking rule of human being's aural characteristic conduct spectrum analysis of the input signal compute the valuation function over two or more partial zones and a bit quota means as bit assignment for quantizing two or more partial zone signals Based on a valuation function perform bit assignment and a quantization means quantizes two or more partial zone signals based on bit assignment. A multiplexing means multiplexes and outputs bit quota information, maximum detection information and sample information. From the bit assignment by the power and the bit quota means of a partial zone signal which a power loss calculating means is outputted from a zone division means a power loss when the bit assignment to a partial zone becomes zero is computed and the maximum is adjusted.

[0049] an embodiment of the invention -- the maximum controller 16 in the 8. above-mentioned embodiment 7 According to the power loss computed by the power loss calculation part 14 it is aimed to compensate the loss and a gain adjustment is performed only to the biggest thing among the maximums to each partial zone detected by the maximum primary detecting element 2. By using this appearance as the above-mentioned Embodiment 7 explained the power loss by bit assignment being zero is compensated by making the power of a partial zone with the biggest maximum increase. A lost part of the partial zone signal component by the bit assignment to a partial zone serving as zero by this can be beforehand compensated with the encoder side. In the maximum controller 16 the biggest partial zone of the power of a partial zone signal may be chosen as a selection method of the partial zone of the object which performs the gain adjustment of the maximum among each partial zone computed by the power loss calculation part 14. Furthermore in the maximum controller 16 it may choose as a selection method of the partial zone of the object which performs the gain adjustment of the maximum judging

from the valuation function outputted from the auditory model part 3. When a conventional example describes as a valuation function and the difference of the maximum of a signal level and the minimum of the mask characteristic is considered the smallest partial zone is chosen. In the above-mentioned example the gain adjustment of the maximum may not be performed only to one partial zone but it may carry out for example from a higher rank to N partial zones.

[0050] an embodiment of the invention -- 9. drawing 13 is shown about the encoder which is an example of this invention. In drawing 13 1-6 are the same as that of the above-mentioned conventional example and they omit the explanation. 14 is a power loss calculation part and 15 is a gain adjustment part. Next operation is explained.

[0051] In the above-mentioned Embodiments 6-8 the power loss calculation part 14 may compute the power of each partial zone signal from spectrum analysis results such as FFT performed in the auditory model part 3 as a calculating method of the power to each partial zone. The explanation is concretely explained based on Embodiment 6. Drawing 13 is shown about the encoder which is an example of this invention.

[0052] Next operation processing is explained. The zone dividing part 1 the maximum primary detecting element 2 the auditory model part 3 and the bit assigning part 4 so once process to an input signal. The power loss calculation part 14 computes the sum total of the power of the partial zone whose bit assignment is zero from the bit assignment determined by the spectrum analysis result and the bit assigning part 4 in the auditory model part 3. The gain adjustment part 15 adjusts the gain of an input signal according to the power loss computed by the power loss calculation part 14. The usual processing is performed to the input signal adjusted by this gain adjustment part 15. The loss of the partial zone signal component by the bit assignment to a partial zone serving as zero by this can be compensated beforehand. In the above-mentioned gain adjustment part 15 a gain adjustment like Embodiment 7 and Embodiment 8 may be performed.

[0053] an embodiment of the invention -- 10. drawing 14 is shown about the encoder which is an example of this invention. In drawing 14 1-6 are the same as that of the above-mentioned conventional example and they omit the explanation. 14 is a power loss calculation part and 15 is a gain adjustment part. Next operation is explained.

[0054] The zone dividing part 1 the maximum primary detecting element 2 the auditory model part 3 and the bit assigning part 4 so once process to an input signal. The power loss calculation part 14 computes the sum total of the power of the partial zone whose bit assignment is zero from the bit assignment determined by the maximum detected in the maximum primary detecting element 2 and the bit assigning part 4. The gain adjustment part 15 adjusts the gain of an input signal according to the power loss computed by the power loss calculation part 14. The usual processing is performed to the input signal adjusted by this gain adjustment part 15. The loss of the partial zone signal component by the bit assignment to a partial zone serving as zero by this can be compensated beforehand. In the above-mentioned gain adjustment part 15 a gain adjustment like Embodiment 7 and Embodiment 8 may be performed.

[0055] an embodiment of the invention -- 11. drawing 15 is shown about the encoder which is an example of this invention. In drawing 15 1-6 are the same as that of the above-mentioned conventional example and they omit the explanation. As for a local decoding part and 12 and 13 a power loss calculation part and 15 are gain adjustment parts the power analyzer and 14 11. Next operation is explained.

[0056]In the above-mentioned Embodiments 6-8the power loss calculation part 14 may compute the power of each partial zone signal from the maximum \*\*\*\*\* (ed) by the maximum primary detecting element 2 as a calculating method of the power to each partial zone. The explanation is concretely explained based on Embodiment 6. Drawing 15 is shown about the encoder which is an example of this invention.

[0057]The local decoding part 11 is the same composition as the decoder shown in a conventional example and performs the same operation. The local decoding part 11 inputs the decode data outputted from the multiplexing part 6 and outputs a decoded signal. The 1st power analyzer 12 computes the power of the input HARASHIN item inputted into an encoder and the 2nd power analyzer 13 computes the power of the decoded signal outputted from the local decoding part 11. The power loss calculation part 14 computes a power loss from the power analysis result outputted from the 1st power analyzer 12 and the 2nd power analyzer 13. The gain adjustment part 15 performs a gain adjustment according to the power loss outputted from the power loss calculation part 14. By this a part for a power loss in case bit assignment serves as zero can be beforehand compensated by operating the power of an input signal. In the above-mentioned gain adjustment part 15 a gain adjustment like Embodiment 7 and Embodiment 8 may be performed.

[0058]Example 1. drawing 16 is shown about the encoder which is an example of this invention. In drawing 16 1-6 are the same as that of the above-mentioned conventional example and they omit the explanation. 12 is the power analyzer. Next operation is explained.

[0059]The power analyzer 12 computes the power of an input HARASHIN item and outputs the information as power information. In the multiplexing part 6 in addition to the bit quota information from the bit assigning part 4 the maximum information from the maximum primary detecting element 2 and the sample information from the quantizing part 5 the power information from the power analyzer 12 is multiplexed and it outputs as coding data.

[0060]an embodiment of the invention -- 12. drawing 17 is shown about the decoder which is an example of this invention. In drawing 17 21-23 are the same as that of the above-mentioned conventional example and omit the explanation. 15 is a gain adjustment part. Next operation is explained.

[0061]The separation part 21 divides coding data into bit quota information, maximum information, sample information, and power information. Power information here is the power of the input HARASHIN item in an encoder. In the inverse quantization part 22 although a partial zone signal is decoded from each previous information, bit assignment cannot decode a partial zone signal about the partial zone which is zero but a partial zone signal serves as zero. Therefore when the partial zone signal exists in an encoder originally the decoded signal outputted from the band composition part 23 is decreasing by the power of the partial zone signal whose bit assignment is zero. In order to compensate the decrement of this power the gain adjustment part 15 performs a gain adjustment performing power calculation of the decoded signal outputted from the band composition part 23 so that this power may be in agreement with the power information of the input HARASHIN item in the encoder outputted from a separation part. By this power of a decoded signal can be made equal to the HARASHIN item. The decoder constituted as mentioned above in short Separating mechanism The power information

from input coding data bit quota information Separate maximum information and sample information and an inverse quantization means Bit quota information A partial zone signal is decoded from maximum information and sample information a band composition means carries out band composition of the partial zone signal and a gain-adjustment means outputs by performing the gain adjustment of a decoded signal by which band composition was carried out according to power information.

[0062] an embodiment of the invention -- 13. drawing 18 is shown about the decoder which is an example of this invention. In drawing 18 21-23 are the same as that of the above-mentioned conventional example and omit the explanation. 14 is a power loss calculation part and 16 is a maximum controller. Next operation is explained.

[0063] The separation part 21 divides coding data into bit quota information, maximum information, sample information and power information. Power information here is the power of the input HARASHIN item in an encoder. Bit assignment distinguishes first the partial zone which is not zero from this bit quota information and the power loss calculation part 14 computes the power of a partial zone signal to that partial zone from the maximum information over that partial zone. Next bit assignment computes the power of the partial zone which is zero from this and the power information from the separation part 21. This power serves as a loss of the power to the HARASHIN item. The maximum controller 16 performs the gain adjustment of the maximum to all the partial zones from the separation part 21 towards compensating the loss according to the power loss computed by the power loss calculation part 14. In the inverse quantization part 22 since reverse normalization is performed using this maximum by which the gain adjustment was carried out power adjustment of the partial zone signal will be carried out and power adjustment also of the decoded signal outputted from the band composition part 23 as a result is carried out. The power of a decoded signal can be compensated by this. In the maximum controller 16 a gain adjustment may be carried out only to the biggest thing among the maximum information over the partial zone outputted from the separation part 21.

[0064] Example 2. drawing 19 is shown about the decoder which is an example of this invention. In drawing 19 21-23 are the same as that of the above-mentioned conventional example and omit the explanation. 14 is a power loss calculation part and 15 is a gain adjustment part. Next operation is explained.

[0065] The separation part 21 divides coding data into bit quota information, maximum information, sample information and power information. Power information here is the power of the input HARASHIN item in an encoder. The power loss calculation part 14 computes the power of the partial zone signal outputted from the inverse quantization part 22. In this inverse quantization part 22 the partial zone signal of the partial zone whose bit assignment is zero is not decoded but when it comes and that partial zone signal exists in an encoder the decoded signal outputted from the band composition part 23 is decreasing by the power of the partial zone signal whose bit assignment is zero. In order to compensate the decrement of this power a power loss is computed from the power of a partial zone signal and the power information from the separation part 21 which are outputted from the inverse quantization part 22 computed previously. The gain adjustment part 15 performs the gain adjustment of the partial zone signal outputted from the inverse quantization part 22 according to the power loss computed by the power loss calculation part 14. As for the decoded signal outputted from the band composition part

23 as a result power will be adjusted. The power of a decoded signal can be compensated by this. A gain adjustment may be performed to the decoded signal after band composition.

[0066]an embodiment of the invention -- 14. drawing 20 is shown about the decoder which is an example of this invention. In drawing 20 21-23 are the same as that of the above-mentioned conventional example and omit the explanation. 24 is a partial zone signal generating part and 25 is an adder unit. Next operation is explained.

[0067]The partial zone signal generating part 24 distinguishes the partial zone whose bit assignment is zero from the bit quota information first outputted from the separation part 21. Next the alternative signal over the partial zone is generated. White noise is generated as this alternative signal. At this time the level of an alternative signal is made equal to the level of lower limit of hearing. This level means the power level of a partial zone signal. This lower limit of hearing is a limit which can be perceived by human being's acoustic sense and if a level is set as this appearance this alternative signal component will not be perceived even after band composition. In the adder unit 25 the partial zone signal decoded by the inverse quantization part 22 as shown in drawing 21 and the partial zone signal generated by the partial zone signal generating part are added. The partial zone signal over all the partial zones is inputted into the band composition part 23 by this addition. In the band composition part 23 each partial zone signal outputted from the adder unit 25 is compounded and the decoded signal of the original bandwidth is outputted. The power of a decoded signal can be compensated by this.

[0068]an embodiment of the invention -- 15. drawing 22 is shown about the decoder which is an example of this invention. In drawing 22 21-23 are the same as that of the above-mentioned conventional example and omit the explanation. 24 is a partial zone signal generating part and 25 is an adder unit. Next operation is explained.

[0069]The partial zone signal generating part 24 distinguishes the partial zone whose bit assignment is zero from the bit quota information first outputted from the separation part 21. Next the alternative signal over the partial zone is generated. White noise is generated as this alternative signal. At this time the level of an alternative signal is specified as follows. Bit assignment distinguishes the partial zone which is zero and the partial zone which is not zero from the bit quota information outputted from the separation part 21. Next bit assignment computes using maximum information as a signal level of the partial zone which is not zero. As a signal level of the partial zone whose bit assignment is zero since maximum information does not exist it asks as follows. The sound to which the partial zone signal of the partial zone whose bit assignment is not zero is made for other sounds as used in the field of a masking effect not to be heard as shown in drawing 23. That is it is regarded as a masker and the bit assignment for which it asked previously calculates the masking threshold of the partial zone whose bit assignment is zero from the signal level of the partial zone which is not zero. Let this masking threshold be a level of an alternative signal. Thus setting out of a level will not perceive this alternative signal component even after band composition. In the adder unit 25 the partial zone signal decoded by the inverse quantization part 22 and the partial zone signal generated by the partial zone signal generating part are added as Embodiment 14 described. The partial zone signal over all the partial zones is inputted into the band composition part 23 by this addition. In the band composition part 23 each partial zone signal outputted from the adder unit 25 is compounded and the decoded signal of the original bandwidth is



outputted. The power of a decoded signal can be compensated by this. The above-mentioned bit assignment may ask as a method of asking for the signal level of the partial zone which is not zero from the decoded partial zone signal which is outputted from the inverse quantization part 22.

[0070]an embodiment of the invention -- 16. drawing 24 is shown about the decoder which is an example of this invention. In drawing 24 21-23 are the same as that of the above-mentioned conventional example and omit the explanation. As for 24 an adder unit and 26 are level information storage parts stores a partial zone signal generating part and 25. Next operation is explained.

[0071]The level information storage parts store 26 memorizes the level information of each partial zone signal in the frame concerned outputted from the adder unit 25 and outputs the level information of each partial zone signal in the past frame. The partial zone signal generating part 24 distinguishes the partial zone whose bit assignment is zero from the bit quota information first outputted from the separation part 21. Next the alternative signal over the partial zone is generated. White noise is generated as this alternative signal. At this time the level of an alternative signal is specified as follows. For example the level information of a frame just before receiving each partial zone memorized by the level information storage parts store 26 is applied as it is. Or the level value predicted from transition of the level information of two or more frames of the past of each partial zone memorized by the level information storage parts store 26 is applied. For example if the level information for two last frames is an upward tendency it will carry out by 1.2 times the just before level information and if it is a downward tendency it may be 0.8 last time. In the adder unit 25 the partial zone signal decoded by the inverse quantization part 22 and the partial zone signal generated by the partial zone signal generating part are added as the above-mentioned embodiment described. The partial zone signal over all the partial zones is inputted into the band composition part 23 by this addition. In the band composition part 23 each partial zone signal outputted from the adder unit 25 is compounded and the decoded signal of the original bandwidth is outputted. The power of a decoded signal can be compensated by this.

[0072]an embodiment of the invention -- 17. drawing 22 is shown about the decoder which is an example of this invention. In drawing 22 21-23 are the same as that of the above-mentioned conventional example and omit the explanation. 24 is a partial zone signal generating part and 25 is an adder unit. Next operation is explained.

[0073]The maximum information over each partial zone separated by the separation part 21 assumes that the maximum to all the partial zones is always included irrespective of whether the bit assignment to each partial zone is zero or it is not zero. The partial zone signal generating part 24 distinguishes the partial zone whose bit assignment is zero from the bit quota information first outputted from the separation part 21. Next the alternative signal over the partial zone is generated. White noise is generated as this alternative signal. At this time the level of an alternative signal is specified as follows. A signal level is computed from the maximum to this partial zone and that level is applied. In the adder unit 25 the partial zone signal decoded by the inverse quantization part 22 and the partial zone signal generated by the partial zone signal generating part are added as the above-mentioned embodiment described. The partial zone signal over all the partial zones is inputted into the band composition part 23 by this addition. In the band composition part 23 each partial zone signal outputted from the adder unit 25 is compounded and the

decoded signal of the original bandwidth is outputted. The power of a decoded signal can be compensated by this.

[0074]an embodiment of the invention -- 18. drawing 25 is shown about the decoder which is an example of this invention. In drawing 25 21-23 are the same as that of the above-mentioned conventional example and omit the explanation. As for 24 an adder unit and 26 are partial zone signal storage parts a partial zone signal generating part and 25. Next operation is explained.

[0075]The partial zone signal storage part 26 memorizes each partial zone signal in the frame concerned outputted from the adder unit 25 and outputs each partial zone signal of the past frame. The partial zone signal generating part 24 distinguishes the partial zone whose bit assignment is zero from the bit quota information first outputted from the separation part 21. Next the alternative signal over the partial zone is generated. The partial zone signal of the previous frame outputted from the partial zone signal storage part 26 is used as this alternative signal. At this time that level is defined as the above-mentioned Embodiments 14-17. In the adder unit 25 the partial zone signal decoded by the inverse quantization part 2 and the partial zone signal generated by the partial zone signal generating part are added as the above-mentioned Embodiment 17 described. The partial zone signal over all the partial zones is inputted into the band composition part 23 by this addition. In the band composition part 23 each partial zone signal outputted from the adder unit 25 is compounded and the decoded signal of the original bandwidth is outputted. The power of a decoded signal can be compensated maintaining the quality of a decoded signal by this.

[0076]an embodiment of the invention -- 19. drawing 26 is shown about the decoder which is an example of this invention. In drawing 26 21-23 are the same as that of the above-mentioned conventional example and omit the explanation. 24 is a partial zone signal generating part and 25 is an adder unit. Next operation is explained.

[0077]The partial zone signal generating part 24 distinguishes the partial zone whose bit assignment is zero from the bit quota information first outputted from the separation part 21. Next the alternative signal over the partial zone is generated. The signal generated as follows is used as this alternative signal. Bit assignment considers that the frequency which represents that partial zone in the partial zone which is zero for example center frequency is fundamental frequency and generates a composite signal from the partial zone signal of the partial zone containing the harmonics and the subharmonic to this fundamental frequency. As a selection method of the partial zone which contains harmonics and a subharmonic here for example or it chooses the partial zone containing the harmonics and the subharmonic up to the n-th order when fundamental frequency is low the harmonics up to the n-th order are chosen or when fundamental frequency is high there is the method of choosing the partial zone containing the subharmonic up to the n-th order. Thus the level of the generated composite signal is defined as the above-mentioned Embodiments 14-17. In the adder unit 25 the partial zone signal decoded by the inverse quantization part 22 and the partial zone signal generated by the partial zone signal generating part are added. The partial zone signal over all the partial zones is inputted into the band composition part 23 by this addition. In the band composition part 23 each partial zone signal outputted from the adder unit 25 is compounded and the decoded signal of the original bandwidth is outputted. The power of a decoded signal can be compensated maintaining the quality of a decoded signal by this. The partial zone

signal which adjoins the partial zone which it is going to generate as a method of generating a composite signal may be compounded and generated from other above partial zone signals.

[0078]

[Effect of the Invention]In this inventionit is possible to provide the coding decryption machine which acquires numerals without a signal power loss and a decoded signal from the HARASHIN item as mentioned above.

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## DESCRIPTION OF DRAWINGS

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[Brief Description of the Drawings]

[Drawing 1]It is a block diagram showing the composition of the encoder in Embodiment 1.

[Drawing 2]It is a figure showing the memory state of the bit assignment table in Embodiments 1 thru/or 4.

[Drawing 3]It is a figure showing the memory state of the bit assignment table in Embodiments 1 thru/or 4.

[Drawing 4]It is a figure showing the state of the partial zone signal in Embodiments 1 thru/or 4.

[Drawing 5]It is a block diagram showing the composition of the encoder in Embodiment 2.

[Drawing 6]It is a block diagram showing the composition of the encoder in Embodiment 3.

[Drawing 7]It is a block diagram showing the composition of the encoder in Embodiment 4.

[Drawing 8]It is a block diagram showing the composition of the encoder in Embodiment 5.

[Drawing 9]It is a block diagram showing the composition of the encoder in Embodiment 6.

[Drawing 10]It is a constitutional diagram of the partial zone signal of Embodiment 6.

[Drawing 11]It is a block diagram showing the composition of the encoder of Embodiment 7.

[Drawing 12]It is a constitutional diagram of the partial zone signal of Embodiment 7.

[Drawing 13]It is a block diagram showing the composition of the encoder in Embodiment 9.

[Drawing 14]It is a block diagram showing the composition of the encoder in Embodiment 10.

[Drawing 15]It is a block diagram showing the composition of the encoder in Embodiment 11.

[Drawing 16]It is a block diagram showing the composition of the encoder in Example 1.

[Drawing 17]It is a block diagram showing the composition of the decoder in Embodiment 12.

[Drawing 18]It is a block diagram showing the composition of the decoder in Embodiment 13.

[Drawing 19]It is a block diagram showing the composition of the decoder in Example 2.

[Drawing 20] It is a block diagram showing the composition of the decoder in Embodiment 14.

[Drawing 21] It is a constitutional diagram of the partial zone signal in Embodiment 14.

[Drawing 22] It is a block diagram showing the composition of the decoder in Embodiment 15.

[Drawing 23] It is a constitutional diagram of the partial zone signal in Embodiment 15.

[Drawing 24] It is a block diagram showing the composition of the decoder in Embodiment 16.

[Drawing 25] It is a block diagram showing the composition of the decoder in Embodiment 17.

[Drawing 26] It is a block diagram showing the composition of the decoder in Embodiment 18.

[Drawing 27] It is a block diagram showing the composition of the encoder in a conventional example.

[Drawing 28] It is a figure showing the power analysis state of the input signal in a conventional example.

[Drawing 29] It is a figure showing the state of the bit assignment in a conventional example.

[Drawing 30] It is a figure showing the power analysis state of the partial zone signal in a conventional example.

[Drawing 31] It is a block diagram showing the composition of the decoder in a conventional example.

[Description of Notations]

1 A zone division means and 2 A maximum value detecting means 3 auditory model means and 4 Bit quota means 5 A quantization means and 6 A multiplexing means 8 reference-bit quota table 9 A reference bit quota means and 10 A power calculating means and 11 Local decoding means The 12 1st power tools of analysis and 13 The 2nd power tools of analysis and 14 Power loss calculating means 15 A gain-adjustment means and 16 [ A band composition means and 24 / A partial zone signal generating means and 25 / An adder unit 26 level-information storage parts store and 27 / Partial zone signal storage part. ] A maximum adjustment device and 21 Separating mechanism and 22 An inverse quantization means and 23

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